poli University
aculty of engineering
Electrical& electronic department
Course No EE352, summer 2012

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Model answer of midterm exam two, date 21/10/ 2012

Duration 2 hours

Answer the following questions:-

$L = N^2 P_m$

Question No 1(30 points)

a) Complete the following formal:-

W_{fld} = -------= -------= -------= --------- j/m^3

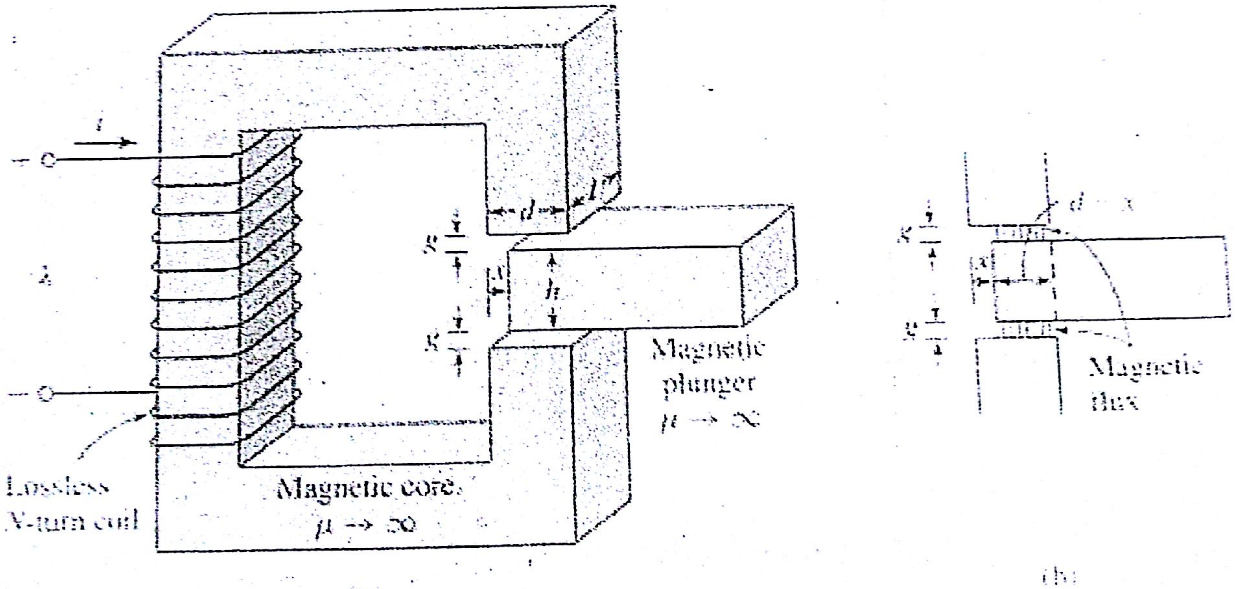
$N^2 P_m i^2$

$F^2 P_m$

$\frac{F\phi}{2}$

b)

The relay shown in fig (1) is made from infinitely – permeable magnetic material with a movable plunger, also of infinitely permeable material. The height of the plunger is much greater than the air-gap length (h >> g) calculate the magnetic stored energy W_{fld} as function of plunger position (0 < x < d) , for N =1100 turns , air-gap length 0.19 cm and d= 14 cm and l= 9 cm and the injected current is 12.5 Amp



(a) (b)

Fig (1)

Question No 2(35 points)

a) Explain with graphs the meaning of energy and co-energy terms in energy conversion topic.

b) An electromagnetic relay as shown in fig (2) has an exciting coil of 800 turns. The coil has a cross sectional area of 5 cm × 5 cm. Neglect reluctance of the magnetic circuit and fringing.

$L(x) = \frac{N^2 \mu_0 A_g}{x}$

$F = \frac{\partial W_f'}{\partial x}\Big|_{i=const}$

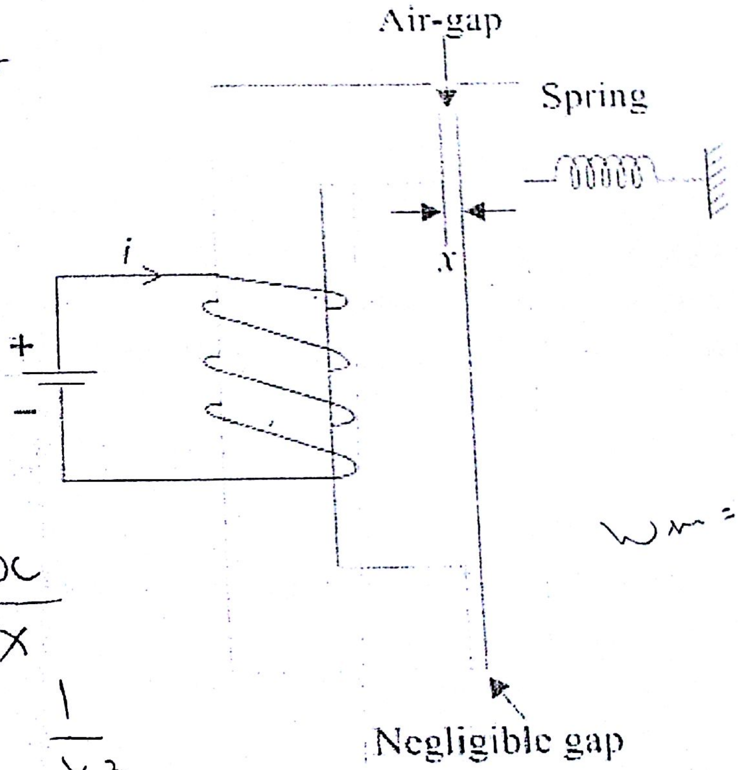
$= \frac{\partial \frac{1}{2} L(x) i^2}{\partial x}$

$= \frac{1}{2} i^2 \frac{\partial L(x)}{\partial x}$

$= \frac{1}{2} i^2 N^2 \mu_0 A_g \frac{\partial 1/x}{\partial x}$

$= \frac{1}{2} i^2 N^2 \mu_0 A_g \times -\frac{1}{x^2}$

$= 0.0015707963 2 \frac{1}{(5 \times 10^{-3})^2} = 62.83$ N



$W_m = \int F\, dx$

Fig(2)

Calculate the following:-

i) The coil inductance, if the air gap length is 5 mm.

ii) The energy stored for a coil current of 1.25 Amp.

$dx =$

$F_2 = \quad = \quad \frac{1}{(25)^2} = {}^2 \; 251.32$

$(40000 - 160000)$

iii) The coil current was 1.25 Amp, calculate the mechanical energy output based on the field energy change when the armature moves to position for which x = 2.5 mm, assume slow movement of the armature.

iv) Repeat (iii), based on force calculations and mechanical displacement

v) What will be change in the above results of the mechanical work done, if the mechanical movement is fast, keeping the flux initially constant?

Question No 3(35 points)

a)

The electrical Libyan system run at 50 Hz, fill synchronous speed of the following types of generators running on this system :-

No of poles	2	4	6	8
Sync. speed				

b)

The phase (a) of two – pole, 3 – phase armature winding as shown in the fig (3), it is consist of 8 N_c- turn full –pith coils connected in series , each slot contain two coils , , the first winding of phase is located at angle of 67.5 from the magnetic axis of phase (a) , i.e (0) degree.

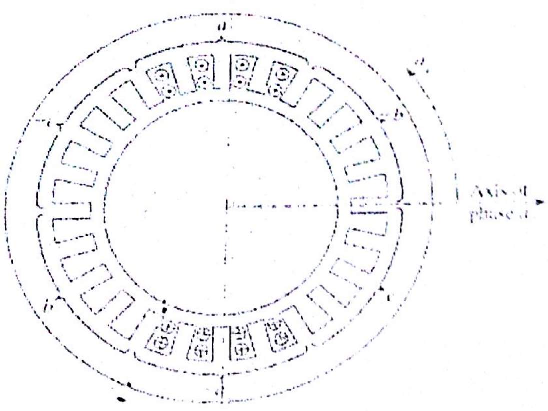


Fig (3)

Find the following:-

I. Total number of armature slots

97.5

112.5

127.5

142.5

II. Locations of all these slots referring from the magnetic axis (phase a).

iii. Write an expression for the space-fundamental mmf of the complete armature winding of phase (b)

iv. Determine the winding factor k_w for distribution winding.

Thank you

I. Falah

50/50 A+

Tripoli University
Faculty of engineering
Electrical& electronic department
Course No EE352, summer 2012

Final exam, date 01/11/ 2012

Duration 2 hours

Answer the following questions:-

Question No 1(30 points)

a) What does mean by self and mutual inductances? Draw these values for two coils case.

b) The laminated sheet steel section shown in fig (1) has a stacking factor of 0.9 . Compute the current required to establish a flux of 1.4×10^{-4} Wb. Neglect fringing. Use B, H curve attached. (Note: - 1 meter = 39.37 inch)

19.28A

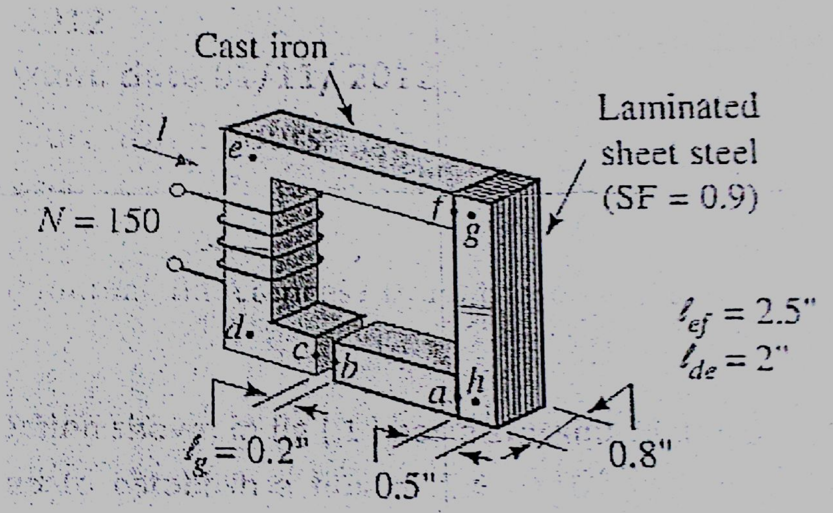


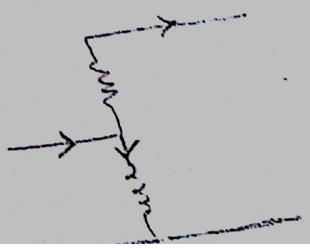
Fig (1)

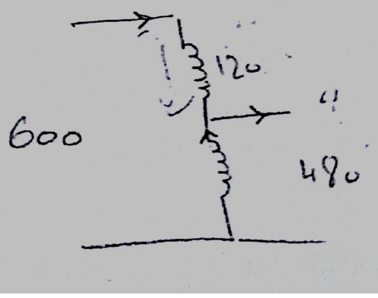
Question No 2 (35 points)

a) Two winding , single phase transformer 480/120 volt , 5000 va, we would like to use it to transform the voltage from 600/480 volt , is it possible ? . If the answer is yes give the following:-

   i. Draw the connection
   ii. The rating of this new transformer S = 24996VA
   iii. The primary and secondary current of this new transformer.

41.66A / 52.075





92.62%

b) 3-Ø , 1.2 MVA , 6.6/1.1 kV transformer , has delta connected primary and star connected secondary. The per phase value of the primary and secondary resistances are 2 , 0.03 Ω respectively. Calculate the efficiency on full load at 0.9 power factor lagging assume 20 kW as an iron loss.

Pc

[illegible] ~ .8 B = 4.4/9

24.669 A

Question No 3 (35 points)

a) A relay has contacts. The force due to current – carrying coil pulls the pivoted arms against spring tension to close the contacts and energize the load. If the pole face is square with 0.635 cm length , and Ø = 0.5 × 10^{-4} Wb . What is the pulling force on the armature?

8Nc

b) The phase – a of 2-pole armature winding has 10 N_c – turns full – pitch coil connected in series , with each slot contain three coils . Assume an angle θ_a is measured from the magnetic axis of phase a .

2

24 slot

Find the following:-

1. Number of armature slots 30
2. The angle separate each slot 12
3. Location of complete phase a (forward and return) slots assume the first slot of phase a at 30^0 from the magnetic axis. 30, 42, 54, 66, 78
4. Write an expression for the space fundamental mmf of phase(a)

F.d+

8Nc

4 gain
4 rel--.

3Ø

2-p

8Nc

Slot =

Thank you

I. Falah

3Ø

Nph = 8Nc

30 slot

$$F = \frac{4}{\pi}\,\frac{2N_c}{2}\, i \cos(\theta_a - 22.5)$$